Component V Riparian/Wetlands Assessment

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Component V
Riparian/Wetlands Assessment

INTRODUCTION

The interactions between **riparian/wetland** [1] areas, streams, and fisheries habitats are discussed in the Introduction section of this manual. The focus of this Riparian/Wetlands component is to describe the assessment techniques for these areas. This portion of the manual is broken into two assessment sections. Section I describes the methods to assess current riparian vegetation conditions, and their impacts on **recruitment** of large wood and shade. Section II describes the methods to characterize wetland conditions in the analysis area. After the wetland section is a list of references for further reading and background information on riparian/wetland characterization. In Appendix A are all of the necessary forms for completing each of these assessments.

SECTION I: RIPARIAN ZONE CONDITION

Critical Questions

1. What are the current conditions of riparian areas in the watershed?

   - To determine conditions, users will examine riparian area width, vegetation types, and vegetation density, stream shading, and the continuity or interruption of the riparian zone from road crossings, streamside roads, and other land uses.

2. How do the current conditions compare to those potentially present or typically present for this **ecoregion**?

   - Users will use Level IV ecoregion vegetation descriptions to complete this comparison.

3. How can the current riparian areas be grouped within the watershed to increase our understanding of what areas need protection and what the appropriate restoration/enhancement opportunities might be?

   - Using information from the riparian evaluation, users will group riparian areas by sources of impact.

Assumptions

1. The riparian vegetation descriptions developed for Level IV ecoregions will provide insight on the most likely vegetation found in riparian zones, and vegetation types with the highest potential to become established in a riparian zone.

2. The vegetation likely to occur in a given riparian zone can be defined by the **Channel Habitat Type** (CHT) and ecoregion, which together integrate important site characteristics i.e., moisture, disturbance, influence of beavers, etc.).

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[1] Terms that appear in bold italic are defined in the Glossary at the end of this component.

3. Large wood (sometimes referred to as **large woody debris**) is an important component of in-stream habitat in ecoregions that historically were forested, or had forested riparian areas. The importance of large wood for in-stream habitat will vary in ecoregions with sparsely forested riparian areas, and those where trees do not naturally occur.

4. Well-stocked riparian stands, often dominated by **conifers**, will provide adequate long-term supplies of large wood to a stream channel. In some situations, riparian stands dominated by hardwoods will contribute important amounts of large wood.

5. Recruitment distance of in-channel large wood will vary by ecoregion, and is a function of potential tree height. The majority of wood recruitment will come from riparian forests within 100 feet of the stream (horizontal distance) or less.

Materials Needed

- 1:24,000-scale Oregon Department of Forestry (ODF) base maps (from Start-Up and Identification of Watershed Issues component).

- CHT maps from the Channel Habitat Type Classification analyst

- Recent **stereo aerial photographs** covering the entire assessment area (from Start-Up and Identification of Watershed Issues component).

- Stereoscope for 3-D viewing of aerial photographs. Although a mirrored stereoscope (with magnification) is preferable, a simple lens stereoscope is adequate.

- Aerial photo scale for measuring riparian area widths, etc. Scale should be the same as the aerial photographs used.

- Map wheel for measuring lengths of riparian areas.

- Land use maps (optional). May be useful in determining land use associated with riparian disturbance.

- Level IV ecoregion map and descriptions of ecoregions occurring in the watershed.

- Stream survey summaries from the Fish and Fish Habitat Assessment that describe riparian vegetation composition and shade summaries (if available).

- Paper copies of Riparian Assessment Forms **or** a spreadsheet set up in the same format. (Note: spreadsheet templates for the various forms needed for the assessment may be available on the Internet; check http://www.state.or.us/agencies.ns/69000/00070/)

Time Needed

Aerial photo assessment time will vary depending on the size of the assessment area, the type of vegetation present, the amount of disturbance in riparian areas, and, most importantly, the skill of the person doing the interpretation. In a test of the methodology, a skilled assessment person was able to interpret riparian conditions at the rate of approximately 11 minutes/mile of stream, or 18 hours/100 miles of stream. The use of a computer spreadsheet rather than paper forms will greatly speed up summarizing and analyzing riparian conditions.

Necessary Skills

Ability to interpret vegetation type, size and density are the most important skills needed for this portion of the assessment. Although a person with no prior experience in aerial photo interpretation could complete this assessment, they should plan on spending considerable time learning the skills needed, and allow ample time to field-verify their initial estimates of riparian conditions (see Start-Up and Identification of Watershed Issues component for listing of references on aerial photo interpretation). Many watershed councils have members or land owners in the watershed with staff who are skilled in aerial photo interpretation, and who should be contacted to either perform the assessment or assist in training others to perform the assessment. Other skills needed include the ability to make measurements from aerial photographs, the ability to read and interpret topographic maps, and the ability to use a computer spreadsheet.

Final Products of the Riparian Zone Condition Section

This assessment will result in the following forms (Appendix A) and maps:

- Form R-1: Riparian Condition Unit Information
- Form R-2: Riparian Recruitment Situation Description
- Form R-3: Riparian Conditions Confidence Evaluation
- Map R-1: Riparian Condition Unit Map
- Map R-2: Riparian Recruitment Situations Map
- Map R-3: Riparian Shade Map

Methods

Overview

This portion of the assessment is conducted using aerial photographs—with field verification as time and interest permits—and produces a database and maps of riparian characteristics. The fundamental mapping unit, for which all information in this portion of the assessment is collected, is defined here as the **Riparian Condition Unit** or RCU. An RCU is a portion of the riparian area for which riparian vegetation type, size, and density remain approximately the same. When riparian characteristics change a new RCU is defined. Each RCU occurs on only one side of the stream (i.e., riparian areas on the opposite side of the stream are separate RCUs).

Information for each RCU is collected on Form R-1 (a separate row for each RCU), and mapped on Map R-1. As a rule of thumb, the minimum length for an RCU should be approximately 1,000 feet; however, there will be situations where a shorter length may be required. Information from Form R-1 will be used to group RCUs into similar **Riparian Recruitment Situations** (i.e., groups of RCUs that have similar characteristics and that may be treated similarly for the purposes of restoration/enhancement) on Map R-2. Finally, information from Form R-1 will be used to group RCUs into similar shade categories and mapped on Map R-2. Use of a computer spreadsheet will greatly facilitate these summaries and groupings.

Step 1: Prepare

All of the items listed in the Materials section should first be gathered. The boundaries of the watershed and subwatersheds should be drawn on the base maps that were completed in the Start-Up and Identification of Watershed Issues component. Consult the Ecoregions appendix of this manual for a listing of potential streamside vegetation types found within the ecoregion(s) within this watershed. The Ecoregions appendix will list potential streamside vegetation by three channel constraint groups: constrained, semiconstrained, and unconstrained. Keep this table handy.

Step 2: Map Riparian Condition Units

Choose a Starting Point

As mentioned previously, the fundamental mapping unit, for which all information in this portion of the assessment is collected, is the Riparian Condition Unit (RCU). Beginning at a logical starting point on the aerial photographs (see Where to Begin sidebar for suggestions), follow along the stream until you encounter changes in any of the following characteristics:

- Vegetation (type, size, density)
- Stream size or other changes
- CHT
- Ecoregion
- Subwatershed

Mark each end of the RCU with a pencil mark perpendicular to the stream, and assign it a number (see Note RCU Number subsection below for suggestions on developing a numbering system). Try to keep each RCU no less than 1,000 feet in length. Remember that each RCU occurs on only one side of the stream (i.e., riparian areas on the opposite side of the stream are separate RCUs).

> **WHERE TO BEGIN**
>
> All of the materials have been gathered together, a base map is laid out on a large table, aerial photos are close at hand, and the daunting task of looking at each stream in the watershed is ahead of you. Where to begin! Although there is no “rule” about where to start or which order to proceed, it is suggested that you begin at the outlet of a small subwatershed and move upstream along the primary stream, picking up each tributary as you go. From there, try looking at a few miles of the largest river in the watershed. Try to pick some areas that are easily accessible from a road so that you can go out and field-check your initial work.

Note Which CHT the RCU is in

Note on Form R-1 what CHT the RCU is in. If the RCU boundaries that you have tentatively selected overlap more than one CHT, than split the RCU into two (or more) RCUs at the CHT boundary(ies). Information about CHTs is necessary to estimate potential vegetation condition (which varies by CHT), as well as to prioritize restoration efforts when completing the Watershed Condition Evaluation component (some CHTs are more responsive to large wood than others).

Note Riparian Assessment Width(s)

The Ecoregion appendix contains tables of Potential Streamside Vegetation for each ecoregion. Although recruitment has the potential to come from as far away from the stream as the site potential tree height, the majority of functional wood is recruited within 100 feet (horizontal distance) or less (depending on ecoregion) of the stream’s edge (e.g., McDade et al. 1990). Riparian areas in some ecoregions will have distinct characteristics within this normal zone of large wood recruitment (e.g., a band of red alder or other hardwoods from 0 to 25 feet [horizontal distance] from the stream edge, and conifers from 25 to 100 feet). Look-up the Potential Streamside Vegetation for ecoregion(s) your watershed is in to determine the assessment width of the riparian area closest to the stream (referred to in the table as Riparian Area 1 or RA1), and the distance for the remainder of the recruitment zone (RA2). The widths of RA1 and RA2 will also change depending on which Channel Constraint Group (Table 1) the RCU falls into. Write down the width of RA1 on Form R-1. Some ecoregions or CHTs will have only one assessment width.

Note Riparian Vegetation Characteristics

Locate RA1 and RA2 on the aerial photos, using an aerial photo scale to identify the widths of each RA if necessary. For both RA1 and RA2 note the riparian vegetation characteristics on Form R-1 using a three-letter code that describes vegetation type (first letter), vegetation size (second letter), and vegetation density (third letter). Choices are given in Table 2. For example, "CSD" would mean a riparian stand that is predominantly conifer, small in size, and dense.

Using the aerial photographs you will be able to detect the relative height of riparian stands, and the relative size of the tree crowns. Relating these characteristics to average stand size is a skill that can only be developed by field-verifying your initial estimates. If any survey information is available for streams in the assessment area, it may also be possible to find descriptions of riparian vegetation that may help to verify estimates that you have made from aerial photos.

Sometimes stand conditions will not be uniform with respect to tree size. An example would be situations where large individual trees (left from an earlier timber harvest) are interspersed within an otherwise small stand. This condition should be noted on Form R-1. If these anomalies occur frequently it may be desirable to define these stands as a separate Riparian Recruitment Situation (discussed below), because enhancement opportunities may be different for these stands.

Table 1. CHTs found in Channel Constraint Groups

Channel Constraint Group	Channel Habitat Types
Constrained channels	LC Low Gradient Confined MC Moderate Gradient Confined MH Moderate Gradient Headwater MV Moderately Steep Narrow Valley BC Bedrock Canyon SV Steep Narrow Valley VH Very Steep Headwater
Semiconstrained channels	ES Small Estuary EL Large Estuary AF Alluvial Fan LM Low Gradient Moderately Confined MM Moderate Gradient Moderately Confined
Unconstrained channels	FP1 Low Gradient Large Floodplain FP2 Low Gradient Medium Floodplain FP3 Low Gradient Small Floodplain

Table 2. Codes to describe vegetation type (modified from WFPB 1997).

Vegetation Type	
C	Mostly conifer trees (>70% of area)
H	Mostly hardwood trees (>70% of area)
M	Mixed conifer/hardwoods
B	Brush species
G	Grass/meadow
N	No riparian vegetation
Tree Size Classes	
R	Regeneration (<4-inch average diameter at breast height (DBH)
S	Small (4- to 12-inch average DBH)
M	Medium (>12- to 24-inch average DBH)
L	Large (>24-inch average DBH)
N	Nonforest (applies to vegetation Types B, G, and N)
Stand Density	
D	Dense (<1/3 ground exposed)
S	Sparse (>1/3 ground exposed)
N	Nonforest (applies to vegetation Types B, G, and N)

Note RCU Number

For each RCU recorded on Form R-1, assign a unique number (RCU#) that links it to the RCU mapped on Map R-1. Write the RCU number on Map R-1 as well.

Complicated systems to number RCUs can be devised; however, it is suggested to simply start with the number "1" and number RCUs sequentially from that point. The additional information collected for each RCU (described below), and the use of a computer spreadsheet to organize the data, will allow you to easily extract information about a particular stream, sub-basin, etc., and will eliminate the need for a complicated numbering system.

Note Stream Bank

On Form R-1 note which stream bank the RCU lies on (R for right bank looking downstream or L for left bank looking downstream). This information is useful for locating the RCU on the map or out in the field.

Measure and Note Length of RCU

Using a map wheel, measure the length of the RCU in feet and note it on Form R-1. This information will be used to summarize the various condition categories of riparian stands.

Note the Name of the Stream (or lake)

Find the name of the stream or lake on the base map and note it on Form R-1. Unnamed tributaries can be numbered sequentially staring with the first unnamed tributary working in an upstream direction. For example, the first unnamed tributary to “Madeline Creek” can be named “Madeline Ck Unn Trib #1,” the second can be named “Madeline Ck Unn Trib #2,” etc. Unnamed tributaries entering other unnamed streams can be named using the same convention (e.g., the first unnamed tributary entering Bear Creek can be named “Bear Ck Unn Trib #1,” the first tributary entering that stream can be named “Bear Ck Unn Trib #1, Unn Trib #1”, etc.). This information is useful for extracting data about a stream of interest.

Note the Name of the Subwatershed

Note the name of the subwatershed on Form R-1. This information is used to summarize riparian conditions by sub-basin.

Note the Ecoregion

Note on Form R-1 the ecoregion that the RCU is in. (If the entire watershed is in the same ecoregion, this column can be left blank).

Note the Stream Size

Note on Form R-1 the stream size (L-large, M-medium, S-small) from the ODF base map. Additionally, if a stream is noted on the ODF base map as being non-fish-bearing, note this on Form R-1 with an “N” suffix. (For example, a small stream that is non-fish-bearing would be noted as “SN”). All RCUs must be split at stream-size breaks. This information is used in the Watershed Condition Evaluation to prioritize restoration projects.

Note Permanent Discontinuities

In some situations the vegetation characteristics of an RCU may be broken up, and recruitment limited by permanent discontinuities. For example, there may be a road within the RCU along the entire length, severely limiting riparian recruitment. If any permanent discontinuity exists within the RCU, and it covers more than 30% of the total area of the RCU, the source of the discontinuity should be noted on Form R-1 (e.g., “Road”). This information will be used to define Riparian Recruitment Situations where permanent discontinuities exist, and will also be used in the Watershed Condition Evaluation to prioritize restoration projects.

Note Stream Shading

RCUs each occur on only one side of the stream, but the amount of shade that the stream experiences is a result of conditions on both sides of the stream. Nevertheless, it is reasonable for our purposes to estimate the amount of shade that each RCU provides independent of conditions on the opposite bank. Using the aerial photographs and Table 3, which provides indicators of stream shading, estimate the shade category (H, M, or L) for each RCU and record it on Form R-1. This information will be used to produce Map R-3, and in the Watershed Condition Evaluation.

Table 3. Shade estimation criteria (modified from WFPB 1997).

Indicator	Shade	Code
Stream surface not visible, slightly visible, or visible in patches	>70%	H
Stream surface visible but banks are not visible	40-70%	M
Stream surface visible; banks visible or visible at times	<40%	L

If any survey information is available for streams in the assessment area, it may be possible to find descriptions of stream shading that may help to verify estimates that you have made from aerial photos.

If you are unfamiliar with estimating shade from aerial photographs, you may wish to field-verify some of your initial estimates. A methodology for measuring shade in the field is given in Appendix B.

Additional Notes

The final item of information gathered for each RCU is any additional notes that might be helpful in defining the Riparian Recruitment Situations (described in Step 4). For example, you might consider recording information on types of land use associated with riparian disturbance, sources of discontinuity, presence of beaver ponds, etc.

At this point, Map R-1 is completed and shows all of the RCUs in the watershed. Form R-1 is also complete, with the exception of the Riparian Recruitment Situations column.

Step 3: Perform Field Verification

Field visits can greatly enhance the understanding of riparian conditions. However, it is understood that all watershed councils may not have the time or resources available to do this. It is possible to generate a basic RCU map without field visits, but the accuracy of the information will greatly improve with field verification. Field verification early in the process (i.e., after a few initial estimates of riparian conditions in a few parts of the watershed) may be the most useful, as it will help you "calibrate" your eye, and give you an understanding of what the aerial photos look like compared to on-the-ground conditions.

Visit a sampling of RCUs to evaluate conditions in the field. Use the following list to guide your field sample selection. Consider visiting those areas where you experienced one or more of the following situations:

- You were unable to determine information required to complete Form R-1 from the maps and photos.
- The information on the map did not match your recollection or data collected in the area.
- The information on different maps or photos conflict with each other.

In addition, sample a range of RCUs scattered throughout the watershed.

Based on the time available, determine a goal for the number of RCUs you will be able to visit. Make a list of areas to be visited using the guidelines above, and refine it to meet your goal. It is difficult to give useful estimates for the time a field visit will take, but be aware that in many watersheds, the travel time to an area will be the most time-consuming step of the field work. Once you are at the site, the RCU can usually be evaluated in less than an hour; sometimes substantially less.

Plan your field day and assemble your materials before visiting the field. The following steps will assist you in this process.

1. Plan an efficient route, and try to determine the most likely spots from which to access or at least view the area. If necessary, contact the property owner and request permission to visit the area. If you do not contact landowners ahead of time, you may wish to carry a letter of explanation to give to landowners. If gaining access to an area is a problem, it may be necessary to view the area from public roadways with binoculars.

2. Generate a field form by either printing the spreadsheet or photocopying Form R-1. Once in the field, evaluate the accuracy of each item in Form R-1.

3. For each area to be visited, assemble a packet that includes a photocopy of the relevant portion of the base map, field form, and aerial photograph.

In addition to field work, data collected from other sampling efforts can be used to validate the mapping. Stream surveys have been completed by a variety of agency and private entities (Oregon Department of Fish and Wildlife [ODFW], US Forest Service, US Bureau of Land Management, tribes, county or local municipalities, etc.). Depending on when the survey was completed and the protocol that was used, the survey may describe riparian vegetation composition and contain shade summaries. The Fish and Fish Habitat Assessment component will help you compile and summarize this survey data. The fisheries analyst will be able to provide available data and a copy of completed Form F-2, which summarizes riparian conditions in stream reaches that have been surveyed.

Step 4: Define and Map Riparian Recruitment Situations

Determining Where Current Recruitment Potential is Adequate

At this point you want to decide, for each RCU, if current riparian conditions provide adequate or inadequate recruitment potential. This task requires comparing current conditions to the potential vegetation descriptions for that ecoregion (see Ecoregions appendix for descriptions; note that potential vegetation descriptions vary by channel confinement classes), using the decision tree shown in Figure 1. If current conditions are as good or better (i.e., conifers are better than hardwoods; large trees are better than medium trees; dense stands are better than sparse stands) than the potential conditions for both RA1 **and** RA2, then current recruitment potential is considered to be adequate. If current conditions are not as good as potential conditions, then recruitment is considered to be inadequate. Note in the Riparian Recruitment Situations column on Form R-1 all the RCUs that have adequate current recruitment potential, and go on to the next step.

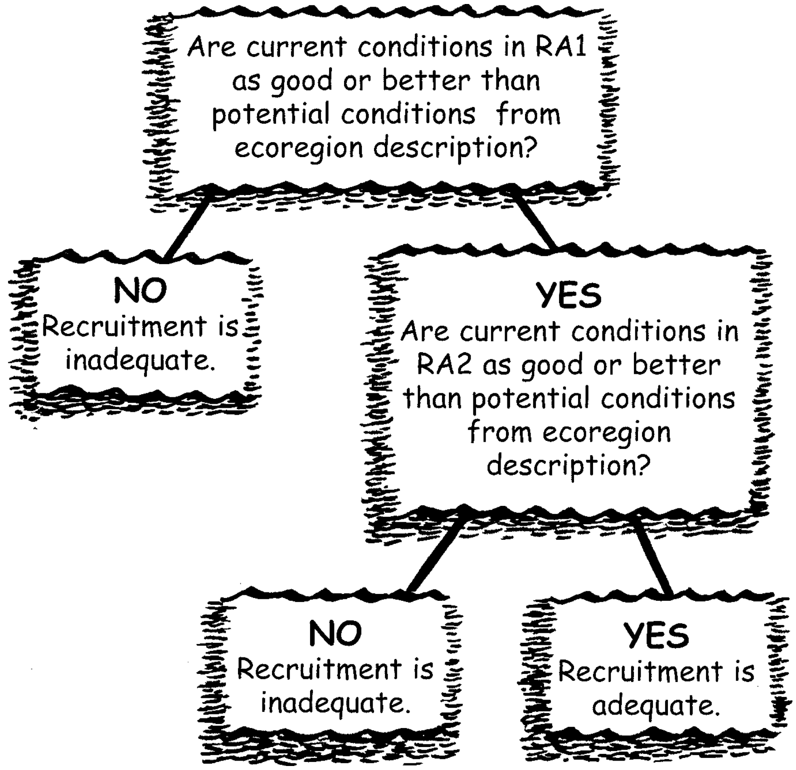

Figure 1. This decision tree will help you determine if current riparian conditions provide adequate or inadequate recruitment potential in a Riparian Condition Unit, by comparing current conditions to the potential vegetation descriptions for that ecoregion.

Defining Riparian Recruitment Situations

You have now determined which RCUs have adequate current recruitment potential, and which do not. You could simply stop at this point; however, you do not know the underlying reasons why recruitment is inadequate, nor do you have any way to logically group RCUs for restoration purposes. Riparian Recruitment Situations are a way to group the RCUs into several categories that may respond to similar restoration treatments, and to summarize the major riparian impacts in the watershed.

At this point you need to define a set of Riparian Recruitment Situations that are appropriate for the watershed in question. The first Situation will always be those stands where current recruitment potential is adequate (determined in the previous step). You now need to go through the notes collected during the aerial photo interpretation and decide on several Situations that make sense for the watershed. Questions to consider when developing Riparian Recruitment Situations for your watershed include the following: What are the land uses that limit recruitment potential? What are the primary stand types (e.g., small conifer plantations, stands of large hardwoods, narrow buffers of hardwoods between agricultural fields and the stream, etc.)? What are the areas where wetlands, residential development, etc., limit tree growth? What are the sources of permanent discontinuities in riparian areas (e.g., roads, power lines, etc.)?

A description of each Situation should be filled out on Form R-2 (one sheet for each Situation), and the Riparian Recruitment Situation noted for each RCU on Form R-1. Examples of Riparian Recruitment Situations from a Coast Range watershed assessment are provided in Table 4.

Mapping Riparian Recruitment Situations

Now all RCUs have been assigned a Riparian Recruitment Situation type on Form R-1, and each Situation has been described on Form R-2. The next step is to assign a mapping color to each Situation and map them on Map R-2. There are two possible approaches to take. The first approach is to overlay a large piece of drafting vellum (a semitransparent material, so the RCU boundaries and numbers can be viewed) on Map R-1 and color all RCUs that are in the same Riparian Recruitment Situation the same color. The second approach is to make a large photocopy of Map R-1 and color-code the Riparian Recruitment Situations. In either case, having Form R-1 in a computer spreadsheet will allow you to sort RCUs and create a list by Riparian Recruitment Situation. A wide felt-tip marking pen works well in coloring the Riparian Recruitment Situations (Figure 2, page V-12).

Step 5: Produce Shade Map

Assign a mapping color to each of the three shade categories described in Table 3. Then, using either a new piece of drafting vellum or a new photocopy of Map R-1, color-code all RCUs that are in the same shade category to produce Map R-3. Again, having Form R-1 in a computer spreadsheet will allow you to sort RCUs and create a list by shade categories.

Table 4. Riparian Recruitment Situations: An example from a Coast Range watershed.

Riparian Recruitment Situation	Description
Adequate	No enhancement needed (dense stands of large-sized conifers).
Small stands	Stands that are generally too small to provide recruitment under current conditions. The land use associated with these stands is forestry.
Large hardwood stands	These stands are also associated with forestry land use. These stands are primarily areas of large hardwoods.
Agriculture	The land use associated with these stands is agriculture. These areas that have no or very narrow buffers between agricultural land and the streams.
Development	The land use associated with these stands is residential development. Buffers are either absent, small hardwoods, or lawns.
Infrastructure	Areas where roads and power lines have created permanent discontinuities in riparian conditions.
Beaver	These are areas where beaver ponds are limiting riparian recruitment.
Wet/meadow	Wetland conditions limit riparian recruitment.

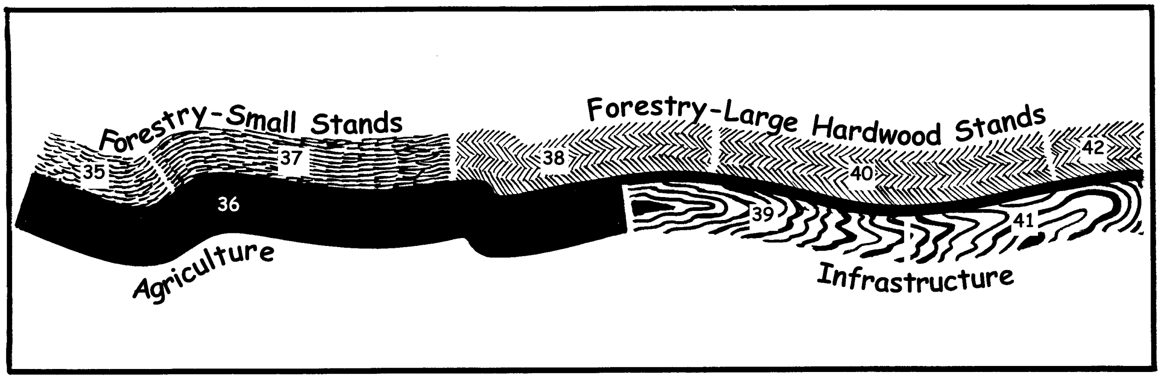

Figure 2. In this portion of a Riparian Recruitment Situation map, similar RCUs (numbered in the figure) are grouped by Riparian Recruitment Situation and color-coded on the map. (Colors are depicted with textures in the figure.)

Step 6: Evaluate Confidence in Riparian Assessment

Using the Riparian Conditions Confidence Evaluation Form (R-3), describe your level of confidence in this assessment. This can include a discussion of the limits of available information, of the amount of field verifying that was possible, and identification of areas where further investigation or data collection might yield either better results or more confidence in the assessment.

Review the critical questions. Are there any questions that it was not possible to answer, for any reason? Can the reason be identified? Does this affect your confidence in one of the areas of analysis? If so, and if the topic of concern has not already been identified on one of the evaluation forms, use the back of the form to describe the situation, and your resulting confidence level.

SECTION II: WETLAND CHARACTERIZATION AND FUNCTIONAL ASSESSMENT

Purpose

Wetlands are protected by federal, state, and local regulations. In order to plan for growth and development in a watershed, it is necessary to know where these resources are. In addition, wetlands can contribute to critical functions in the health of a watershed, as discussed in the Introduction section of this manual. Determining the approximate location and extent of wetlands may be essential in solving problems within the watershed.

The purpose of the wetland characterization is to gain specific information on the location and attributes of wetlands in the watershed, including (but not limited to) size, habitat type, surrounding land use, **connectivity**, and opportunities for restoration. This process will also assist in determining the relationship between wetlands and problems in the watershed that are identified through other assessments conducted in the watershed analysis process. In addition, the method will help watershed councils determine whether it is appropriate or necessary to collect additional data on wetland function.

Critical Questions

1. Where are the wetlands in this watershed?

   - Wetland locations will be identified and mapped using National Wetland Inventory (NWI) maps, aerial photos, and other resources.

2. What are the general characteristics of wetlands within the watershed?

   - The characteristics or attributes of known wetlands will be documented.

3. What opportunities exist to restore wetlands in the watershed?

   - Restoration opportunities that are obvious from aerial interpretation, such as presence of **fill**, clearing, grazing, or ditching in wetlands, are identified in the wetland characterization, which results in a list of possible restoration sites.

Assumptions

1. Wetlands are protected by federal, state, and local regulations. In order to plan for growth and development in a watershed, it is necessary to know where these resources are. In addition, wetlands can contribute to critical functions in the health of a watershed, as discussed in the Watershed Fundamentals component of this document. Determining the approximate location and extent of wetlands may be essential in solving problems within the watershed.
2. Although there is no definitive correlation between readily observable wetland conditions, such as size, habitat type, etc., and the functions the wetland provides, this information can offer some indications. As examples, a wetland connected to a stream has a high likelihood

of providing winter fish habitat, while a large wetland in the middle elevation of the watershed may contribute significantly to flood control.

3. Some restoration opportunities are obvious from aerial interpretation. However, wetland restoration is complex, and the process outlined in this document will only provide a first-cut at identifying restoration opportunities.

Materials Needed

A number of existing resources may be available to assist in identifying wetlands in the watershed. Although all of these may not be available, assemble as many of these as possible before beginning. The following list presents these resources in descending order of usefulness for this project.

- **Local wetland inventory.** Several (45 at the time of this printing) of the communities in Oregon have completed local wetland inventories. Most of these have focused on urban areas. To determine what is available for your watershed, contact the Oregon Division of State Lands at (503) 378-3805.

- **National Wetland Inventory (NWI) maps.** NWI maps are available for the most of Oregon. These maps are produced by the US Fish and Wildlife Service. Using US Geological Survey (USGS) quadrangle maps as a base, NWI maps indicate the location, size, and habitat type of wetlands. Maps may be purchased either through the Oregon Division of State Lands at (503) 378-3805, or from the USGS at (800) USA-MAPS.

  These maps are also available digitally, which will be extremely valuable if maps for the project will be produced on a **Geographic Information System** (GIS). NWI digital data can be purchased through the agencies listed above, and are also available free of charge via the Internet. The NWI's World Wide Web server can be accessed at http://www.nwi.fws.gov/. This web site is organized by 1:250,000-scale quadrangle maps. Each of the folders listed is the name of a 1:250,000-scale map. Determine the names of the 1:250,000-scale maps for your area, and look for that folder; within each folder is data for each 7.5-minute quadrangle map in that area. Figure 3 presents the status of NWI maps in Oregon.

- **Aerial photos.** Information on how to obtain aerial photographs for the project is provided in the Start-Up and Identification of Watershed Issues component of this manual. These photos can be invaluable at verifying and updating information from other resources, viewing the entire wetland when areas are not accessible, looking at how wetlands may be connected to streams, and determining the dominant vegetation type, surrounding land use, and disturbances.

- **Soil survey maps.** Soil survey maps are prepared by the Natural Resource Conservation Service (NRCS; formerly the Soil Conservation Service). In some instances, wetlands can be identified by comparing the mapped soil type with the list of **hydric soils** for the State of Oregon. However, in order to meet the federal and state wetland definitions, **wetland vegetation** and **hydrology** must also be present; hydric soils alone do not definitely indicate wetlands. Hydric soils can also be used to identify areas that were formerly wetlands—if an area is mapped as having hydric soils but is not currently a wetland, it may be that a wetland was present that has been drained or otherwise eliminated. Soil surveys are usually available free of charge. To order, contact NRCS at: State Conservationist, Federal Building, Room 1640, 1220 SW 3rd Avenue, Portland, OR 97204-3221; (503) 414-3201. The hydric soils list for the State of Oregon is available on the Internet at: http://www.statlab.iastate.edu/soils/hydric/sslists.html.

- **USGS topographic maps.** These maps will have been gathered for other portions of the assessment. These maps show lakes, ponds, and some wetlands, in addition to other helpful features such as topography, roads, and other landmarks.

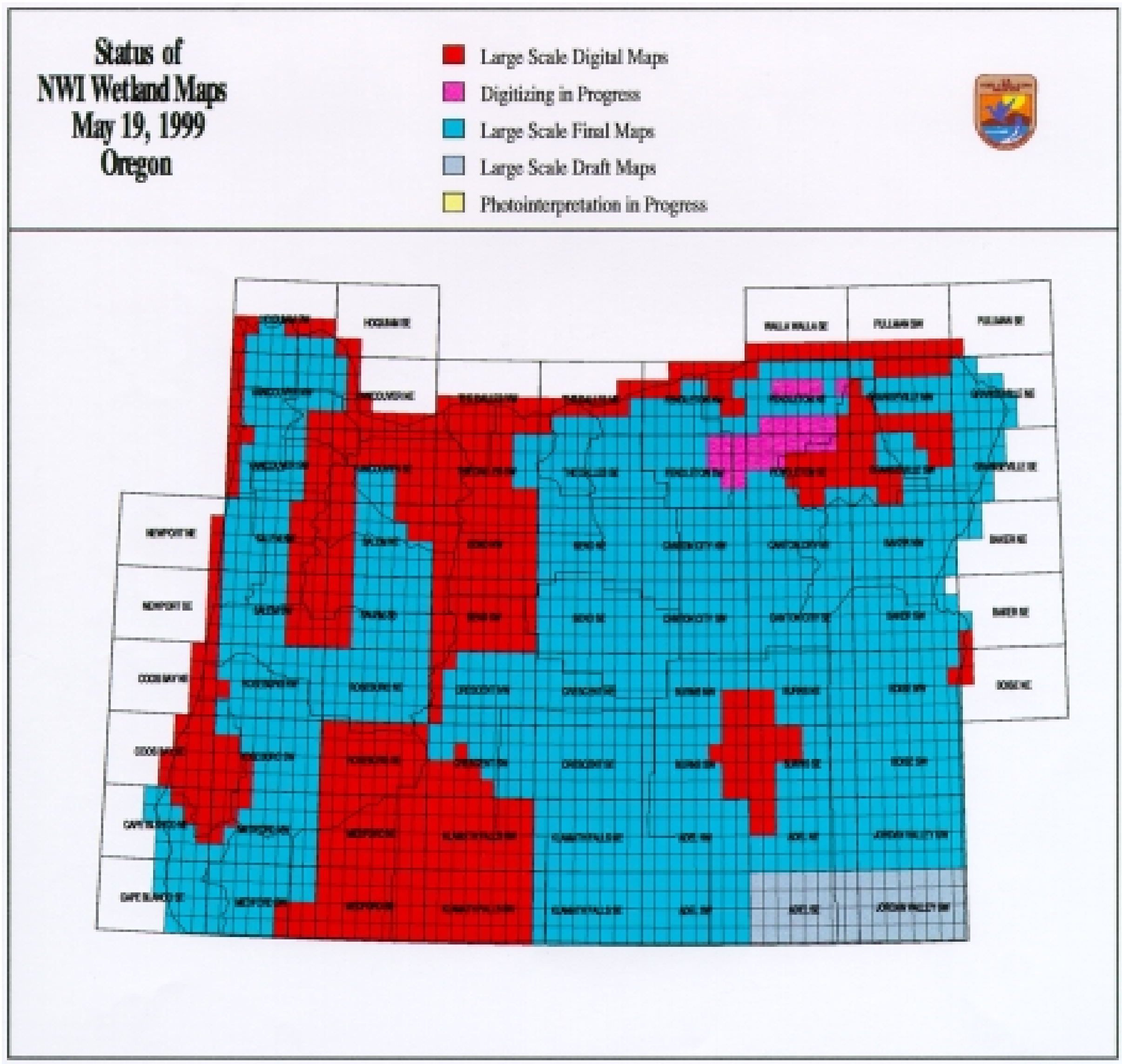

Figure 3. National Wetland Inventory (NWI) maps are available for the most all of Oregon. Produced by the US Fish and Wildlife Service, these maps indicate the location, size, and habitat type of wetlands.

Necessary Skills

The analyst for this assessment must be able to do the following:

1. Interpret aerial photographs.
2. Read maps.
3. Organize information in a spreadsheet (recommended but not required).

Final Products of the Wetland Characterization Section

- Map W-1: Wetland Locations
- Form W-1: Wetland Attributes
- Form W-2: Confidence Evaluation
- Form W-3: Wetland Functions Table (optional)

Wetland Characterization Methods

The flow chart provided in Figure 4 presents the general steps necessary to complete the wetland characterization and assessment. Each of those steps are explained in greater detail in the following pages. Before beginning this process, it is strongly urged that you read through each of the steps. Although each step is laid out in a separate, sequential fashion, it may be most efficient to be working various steps concurrently. For example, you may wish to be developing the Table of Wetland Attributes (Step 5) at the same time that you are creating the Wetland Locations Map (Step 2).

Step 1. Gather and Evaluate Existing Resources

Obtain as many of the maps identified in the Materials required section as are available. Review the maps you have gathered to identify which is the most complete starting point for the wetland inventory. Select the most detailed wetland map available to be the base map.

Step 2. Integrate Resources to Create Preliminary Wetland Map

If the project will not be using GIS, generate a wetland base map by using the most complete of the maps gathered in Step 1. If you will not be using GIS, and your area does not have a local wetland inventory for the entire watershed (this will be true in most cases), the most useful base map will be the NWI map(s). Draw the watershed boundary on the base map(s) using the startup map provided. (See the Start-Up and Identification of Watershed Issues component of this document for more information on how to generate a base map.) If a portion of the watershed has a wetland inventory, you can transfer that information to the NWI map, and consider it to be more accurate than the NWI maps.

Use personal knowledge, other maps, and aerial photographs to modify the base map with the addition of wetlands. If you will be using NWI maps as a base, look at only the area greater than 200 feet from the channel. This is to avoid having to examine the very complex NWI mapping that can occur near the channels. If the map for your area is not complex and difficult to interpret, you may choose to include the channel areas in the assessment at this time. Do not include NWI-mapped wetlands that begin with the letter "R" (for riverine). For the purpose of this project, the

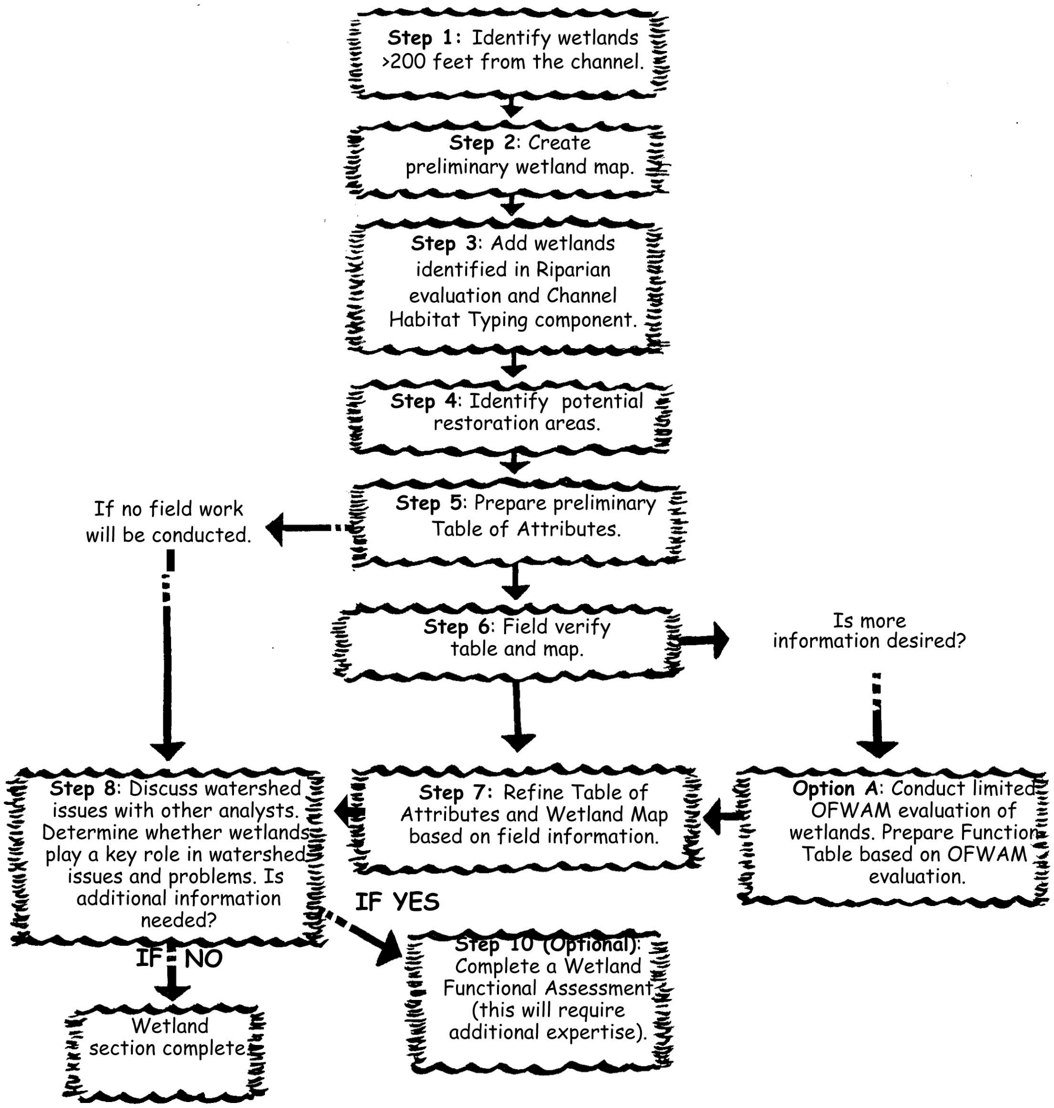

Figure 4. This flow chart presents the general steps necessary to complete the wetland characterization and assessment. Although each step is laid out in a sequential fashion, it may be most efficient to be working various steps concurrently.

characterization will not include most rivers as wetlands (with the exceptions identified in Step 3). If mapping near the channel is complex, ignore the channels at this time. Wetlands near the channel will be added during Step 3.

Step 3. Add Wetlands Identified in Riparian Evaluation and CHT Analyses

Interview the people doing the Riparian and Channel Habitat Type Classification evaluations to gather information about wetlands within 200 feet of the channel. Add any areas that they have identified in their work near the channel to your wetland base map.

Include anything identified by the riparian analyst as potentially wetland. This may include wet meadows, shrub areas, or forests. To confirm these wetlands, examine NWI maps, aerial photographs, and soil survey maps. If the area is indeed a wetland, the other sources should support that finding. If it is not clear, add it to the map, and tag it for field verification (Step 6).

Wetland areas may also be present in riparian areas mapped with the following channel habitat types:

- FP1—Low Gradient Large Floodplain
- FP2—Low Gradient Medium Floodplain
- FP3—Low Gradient Small Floodplain
- LM—Low Gradient Moderately Confined
- MM—Moderate Gradient Moderately Confined
- AF—Alluvial Fan
- ES—Estuary, Small
- EL—Estuary, Large

These areas should also be confirmed by examining maps and photos to determine whether or not they are wetlands. If they are or are likely to be wetland, they should be added to the map.

Step 4. Identify Restoration Opportunities

Add potential restoration areas to the map. Restoration areas would include disturbed wetlands or wetland buffers, or areas that were formerly wetland but have been converted to other land uses. These can be located on the maps and photos by looking for the following situations:

1. Areas show up as wetland in one source, but recent aerial photographs or personal knowledge indicate filling, clearing, grading, ditching/draining, or diking in the same area.

2. One of the following modifiers is indicated on the NWI map:
   d = partially drained/ditched
   f = farmed
   h = diked/impounded

3. The soil survey indicates hydric soils, but the area does not appear to be wetland currently, based on other sources.

NOTE: This is only a first-cut at identifying possibilities, and does not indicate that these areas are necessarily appropriate or feasible sites to restore. If, later on in this process, wetland restoration is identified as a goal, a more thorough analysis of restoration potential should be conducted by individuals with expertise in wetland restoration.

Step 5. Generate Preliminary Table of Wetland Attributes

Use Form W-1, or create a spreadsheet with similar columns. If you have more than a few wetlands, it may be extremely helpful to use a spreadsheet instead of the form provided, because it will allow you to tabulate summary information in various ways with ease, should you wish to do that in the future.

Gather and enter the following information into the form or spreadsheet:

> **HOW TO CALCULATE WETLAND ACREAGE**
>
> 1. Determine the scale of your map or photo (e.g., 1 inch = 2,000 feet)
> 2. Measure the approximate length and width of the subject wetland.
> 3. Multiply the length in inches times the scale of the map, and do the same for the width.
> 4. Multiply the resulting numbers by each other.
> 5. Divide the result by 43,560. The answer will be the wetland area, in acres, of the wetland.
>
> **Example:**
>
> Map scale: 1 inch = 2,000 feet
> Wetland on map = 0.5 inches by 1.0 inches.
> Formula: [(0.5 x 2000) x (1 x 2000)] ÷ 43560 = 45.9 acres

- Wetland ID: Assign an identifying number to each wetland. A suggested format for the ID number is Township, Range, Section, and then a consecutive number. For example, 13-20N-4E-1, 13-20N-4E-2, refer to two different wetlands within Section 13, Township 20 North, Range 4 East. Update your map and data form concurrently by adding the identifying number to the base map.

- Sub-basin. Enter the appropriate sub-basin. This can be useful later on if a particular sub-basin is identified as having a unique issue. Sub-basin information should be provided on the base map provided for the project.

- Size. Estimate the size of each wetland in acres (see the sidebar above). Sources for this information include NWI maps and aerial photographs. Use the source that offers the best (largest) scale on which to measure wetland size.

- Connected. If possible, determine whether there is a surface-water connection between the wetland and a stream. This is often difficult to do without field verification. A wetland is connected if some part of it has a surface-water connection to a **seasonal or perennial surface water**, including natural and man-made channels, lakes, or ponds. If there is an obvious stream inlet or outlet shown on the map, enter "Y" (yes) in this column. If the wetland appears to be isolated, (meaning no surface connection to a stream or ditch), enter "N" (no). If you are uncertain, enter "U" (unknown). If wetlands are connected, they are more likely to provide fish habitat. Sources for this information include NWI maps, aerials, and USGS topographic maps.

- Cowardin Classification Code: (From NWI map). Each wetland shown on the NWI map will have a code that provides some information about the wetland. Generally, the first three letters are the most important for this purpose. This will indicate the class (e.g. palustrine, riverine, etc.) and the subclass (e.g. forested, emergent, etc.). Use the legend provided on the map (Table 5 provides a summary) to interpret the remaining codes. If the NWI map indicates more than one code, list all codes in separate columns in the form or spreadsheet. Note that these NWI codes may be helpful in identifying restoration opportunities, as described in Step 4.

- Buffer: Using the aerial photographs, list the dominant land use within 500 feet of the wetland edge. Use the following codes: **Fo** = forest or open space, **Ag** = agriculture (pasture, crops, orchards, range land), **R** = rural (mix of small-scale agriculture, forest, and/or rural residential), or **D** = developed (residential, commercial, industrial). If more than one of these exists, list the dominant (>50% of the area) land use. If two land uses are fairly equally represented in the buffer, list them both.

Table 5. NWI map legend.

Letter Code	Definition	Comment	Subcategories
M = Marine	Consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the water regimes are determined primarily by the ebb and flow of oceanic tides.	These will normally be outside of the watershed assessment areas.	1 = subtidal 2 = intertidal
E = Estuarine	Deepwater tidal habitats and adjacent tidal wetlands that are semi-enclosed by lands but have open, partially obstructed, or sporadic access to the open ocean, and in which open water is at least occasionally diluted by freshwater runoff from the land.	These areas are only along the coast.	1 = subtidal 2 = intertidal
R = Riverine	Includes all wetlands and deepwater habitats contained within a channel, except: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) areas with water containing ocean-derived salts in excess of 0.5 parts per thousand.	Rivers will be addressed in the CHT component of this manual. Only map those CHTs listed in Step 3 as wetlands.	1 = tidal 2 = lower perennial 3 = upper perennial 4 = intermittent 5 = unknown perennial
L = Lacustrine	Includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, mosses, or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 hectares (20 acres).	Include lacustrine habitats on the wetland map.	1 = limnetic 2 = littoral
P = Palustrine	Includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand.	The majority of wetlands in a watershed will usually fall into this category.	EM = Emergent: Dominated by rooted herbaceous plants, such as cattails and grass. FO = Forested: Dominated by trees taller than 20 feet. OW = Open Water: No vegetation evident at the water surface. SS = Scrub-shrub: Dominated by shrubs and saplings less than 20 feet tall. UB = Unconsolidated Bottom: Mud or exposed soils.

Source: Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Fish and Wildlife Service, FWS/OBS-79-31, Washington DC.

- Position in Watershed: Using the USGS topographic maps, divide the watershed into thirds, and determine where the wetland falls: highest, middle, or lowest third. To divide the watershed into thirds, locate the highest and lowest elevations in the watershed and subtract the lowest from the highest. Divide the result by three. The resulting number represents the change in elevation that will occur within each third of the watershed. Add this number to the lowest elevation. Any wetlands that fall between the lowest elevation and the number you derived are in the lowest third of the watershed. Continue calculating in the same way to determine the middle and highest thirds. It is not uncommon for the lowest third of the watershed to contain a disproportionate amount of land area. In other words, this process divides the watershed into thirds topographically, but will probably not result in equal areas of land in each third.

- Field Visit. In this column, indicate whether a field visit would be especially helpful to clarify conditions at the wetland.

- Restoration/Enhancement Potential. Identify obvious recent impacts, such as clearing, grading, or filling, in or near the wetland. In addition, add any areas to the table that are not currently wetland, but you suspect were wetland in the recent past. For these areas, enter "Possible Former Wetland" in the wetland identifier column (instead of a number), and fill in as much of the attribute information as possible. In these instances, add the Township, Section, and Range to the comments column so that you can readily locate the area.

- Source. Identify the source of the information so that you can readily go back to the original data if needed.

- Comments. You may wish to add comments to indicate other information that you have learned about the wetland, or questions you would like to answer during field work.

Step 6. Conduct Field Visits

Field visits can greatly enhance the understanding of the watershed. However, it is understood that all watershed councils may not have the time or resources available to do this. It is possible to generate a basic wetland map without field visits, but the accuracy of the information will greatly improve with field verification. If you will not be doing any field work, go to Step 8 and continue from that point forward. If you will be visiting the wetlands, you may choose to also conduct a limited functional assessment. Read Step 6 Option A before you make this decision.

Visit a sampling of wetlands to evaluate conditions in the field. To guide your field sample selection, consider visiting those wetlands for which one of the following situations is true:

> **WHY DETERMINE WATER SOURCE FOR A WETLAND?**
>
> Determining the source of water for a particular wetland can be helpful in determining the role of the wetland in the watershed as well as its sensitivity to disturbance. In addition, this information will be useful if wetlands will later be classified per the hydrogeomorphic approach
>
> [For more information, see page 26, Hydrogeomorphic (HGM) Approach for Oregon]

- You were unable to determine information required to complete the Table of Wetland Attributes from the maps and photos.

- The information on the map does not match your recollection of the area.

- The information on different maps or photos conflict with each other.

In addition, sample a range of wetland classes types (from the Cowardin codes, such as palustrine forested, palustrine emergent, and palustrine scrub-shrub), wetland sizes, and wetlands scattered throughout the watershed.

Based on the time available, determine a goal for the number of wetlands you will be able to visit. Make a list of wetlands to be visited using the guidelines above, and refine it to meet your goal. It is difficult to give useful estimates for the time a field visit will take, but be aware that in many watersheds, the travel time to a wetland will often be the most time-consuming step of the field work. Once you are at the site, a small or medium-sized wetland (less than 5 acres) can usually be evaluated in less than 1 hour, sometimes substantially less time.

Plan your field day and assemble your materials before visiting the field. The following steps will assist you in this process.

1. Plan an efficient route, and try to determine the most likely spots from which to access or at least view the wetland. If necessary, contact the property owner and request permission to visit the wetland. If you do not contact landowners ahead of time, you may wish to carry a letter of explanation to give to landowners. If gaining access to an area is a problem, either because of landowner opposition or remote location, it may be necessary to assess the wetland from public roadways with binoculars, or to eliminate those wetlands from the sample and replace them with other accessible sites.

2. Generate a field form by either printing the spreadsheet or photocopying Form W-1, and using the two columns labeled “Water Source” and “Outlet.”

3. For each wetland to be visited, assemble a packet that includes a photocopy of the relevant portion of the wetland map, newly generated field form, and aerial photograph.

Once in the field, evaluate the accuracy of each item in the Table of Wetland Attributes, and the size and location of the wetland shown on your map. If possible, determine the water sources (groundwater, sheetflow, channel, overbank flooding, precipitation), and the presence and condition of the outlet (none, culvert, channel). See Table 6 for more information on how to determine water source. Many wetlands may have more than one water source; indicate all that apply.

Table 6. Guidance on determining water source.

Water Source	Indicators
Channel	Wetland will have well-defined inlet and outlet. Water flows through the wetland.
Overbank flooding	Wetland is within the 100-year floodplain of a river or stream.
Precipitation	All wetlands will have this as one of the water sources, but in some unique situations, it will be the only source. These wetlands will be on topographic high points, and are likely to support bog communities.
Sheetflow	These wetlands receive water from the surrounding lands. Water does not enter the wetland through a defined channel, but flows downhill from surrounding lands across a broad area. These wetlands are lower than the surrounding landscape and have no defined inlet.
Groundwater	This is often very difficult to determine from field assessment. Two obvious situations in which groundwater plays a key role are springs or hillside seeps, where water is actually observed emerging from the ground. Other situations may require more detailed studies to determine whether groundwater is a major water source. If you are uncertain, indicate this on the field form.
Tidal flow	These wetlands can be either freshwater or saltwater, but are subject to tidal flows. Estuarine wetlands are included in this category.

Option A. Conduct Limited OFWAM Evaluation of Wetlands

The Oregon Freshwater Assessment Methodology (OFWAM; Roth et al. 1996) was developed specifically for use in Oregon. It is intended to be used by planners and others who are not wetland specialists for general planning and educational uses. The benefits of this approach are that it is rapid, usable by nontechnical individuals, and is locally relevant. One of the primary drawbacks to OFWAM is that it does not provide resolution between wetlands that provide a certain function. For example, the method may lead to a conclusion that eight wetlands in the watershed have intact water quality functions, but it will not help to assess whether any of these are more important than others at improving water quality. Conducting an OFWAM assessment will assist in developing a general overview of the wetlands and their functions in the watershed, but it will not rank or prioritize them.

OFWAM assesses six wetland functions:

1. Wildlife habitat
2. Fish habitat
3. Water quality
4. Hydrologic control
5. Education
6. Recreation

and assesses three wetland conditions:

1. Sensitivity to impacts
2. Enhancement potential
3. Aesthetics.

Each watershed council should make the decision as to whether information gained by an OFWAM evaluation is useful. If you will already be visiting a wetland, this step would take approximately 30 additional minutes per wetland. This time estimate will vary considerably with the expertise of the observer, familiarity with the method, and complexity and size of the wetland. It is expected that the first few wetlands will take considerably longer to assess than subsequent wetlands, as you become more familiar with the questions. Additional time will be required to organize the data and assemble a summary table.

To complete this step, obtain the OFWAM manual from: Wetlands Program, Oregon Division of State Lands, 775 Summer Street NE, Salem OR 97310; (503) 378-3805. Follow the instructions provided in the manual.

The final step in completing a limited OFWAM Evaluation is to assemble and finalize all data sheets prepared during the field assessment. Prepare a summary table per the example below.

Example of Function Summary Table

WL ID	Wildlife Habitat	Fish Habitat	Water Quality	Hydro-logic Control	Sensitivity to Impact	Enhance-ment Potential	Educa-tion	Recrea-tion	Aesthetic Quality
13-4w-7e	Intact	Intact	Impacted or degraded	Not present	Potentially sensitive	Moderate	Not assessed	Not assessed	Not assessed

Step 7. Refine Table of Wetland Attributes and Wetland Map

After the field work is complete, it will likely be necessary to correct the map and Table of Wetland Attributes. Enter any changes into the spreadsheet or, if you are not using a spreadsheet, update the form. Redraw the size, shape, and location of wetlands on the base map if necessary.

Step 8. Determine if Wetlands Play a Key Role in Watershed Issues and Problems

Wetlands can play a significant role in the watershed issues identified during the other assessment components. Determining the role and function of wetlands can be very complex and related to a variety of factors in the watershed. During the Watershed Condition Evaluation step, all participants in the watershed assessment should be present, and will provide information regarding their findings. Usually, a few key issues will surface as problems affecting the health of the watershed. Table 7 is provided as a general guide to some of the more common wetland-related issues this can be used to help identify if wetlands may play a key role in specific watershed functions.

Step 9. Determine if Additional Data Collection is Appropriate

The confidence in the data depends on a number of factors, including the analyst's skill and knowledge of the watershed, the tools (such as photos, maps, etc.) available, expertise of the analyst, and the degree of field verification of the data. Form W-2 provides a general guide to help evaluate confidence. This form will also assist in identifying ways in which to improve confidence in the data and to identify where additional data may be the most useful.

Table 7. Relationship between watershed issues and wetlands.

Watershed Issue	Relationship to Wetlands	Indicators that Wetland May Perform Function	Possible Additional Data Needs
Insufficient winter salmonid rearing habitat	Wetlands adjacent and connected to the channel can provide this.	Wetland must have direct, passable connection to a stream with anadromous fish.	Assess wetlands in key locations (connected or likely connected to channel) for opportunities and constraints.
Frequent flooding	Wetlands can help to reduce flooding by temporarily retaining water upslope.	Positioned in the middle of the watershed; topographic depression; outlet constrained.	Identify whether important wetlands have been filled or drained. Evaluate possibilities for restoration.
Insufficient flows for fish during dry months	Wetlands can be sites of groundwater discharge.	Groundwater seeps that flow year round; wetlands that store surface water year round.	Locate and protect wetlands that may provide this function.
Sedimentation in streams	Wetlands can filter sediments from surface-water runoff.	Wetland receives degraded runoff that ultimately enters the channel; wetland densely vegetated.	Identify degraded (e.g., cleared, graded, ditched/ drained) wetlands in key locations that could be replanted to restore water quality functions.

If confidence in the assessment is low, you may want to take steps to improve the confidence. This will be especially important if a watershed issue that has a direct link to wetlands (see Table 7) is identified. To improve confidence, it may be desirable to conduct a functional assessment of wetlands. Functional assessment is also recommended if wetland restoration has been identified as a goal by the watershed council. Understanding what functions are being performed, and to what degree, will help prioritize restoration goals.

Option B: Wetland Functional Assessment

The wetland functional assessment step should be undertaken when issues identified during Step 9 have a strong link to wetlands. However, the functional assessment is beyond the capabilities of most watershed councils; therefore, this manual provides only general information about wetland functional assessment, but detailed step-by-step instructions are not offered here. Final products will vary based on the approach selected and the goals of the watershed council.

Besides the OFWAM, which is discussed above (Option A. Conduct Limited OFWAM Evaluation of Wetlands), a number of different functional assessment methods currently exist, and others are under development. Brief descriptions of a few of the available tools are provided below, and Table 8 summarizes information about where the different functional assessment tools may be used. It is recommended that technical expertise be employed to conduct this step, and that the expert assist in determining an appropriate method.

Table 8. Summary of Wetland Functional Assessment Methods by Habitat Types.

Method	Use for Palustrine Wetlands?	Use for Estuaries?
Process for Assessing Proper Functioning Condition for Lentic Riparian/Wetland Areas	Yes	No
Hydrogeomorphic Approach for Oregon (HGM)	Yes	Yes
Indicator Value Approach (IVA)	Yes	Yes
Wetland Evaluation Technique (WET)	Yes	Yes
Oregon Freshwater Assessment Methodology	Yes	No

Note: This table does not include marine, lacustrine, or riverine habitats, because these are not likely to be assessed as wetlands during this process.

Process for Assessing Proper Functioning Condition for Lentic Riparian/Wetland Areas

This method (from US Department of the Interior Bureau of Land Management 1994) provides a process for assessing proper functioning condition for **lentic riparian/wetland areas**. Lentic riparian areas have standing water, such as lakes, ponds, seeps, bogs, and meadows. This approach requires a multidisciplinary team that would include vegetation, soil, hydrology, fish, and wildlife specialists. After an area is assessed, a summary determination is made that includes a functional rating (proper functioning condition, functional–at risk, nonfunctional, or unknown) and a trend for functional–at risk rating of upward, downward, or not apparent. One of the drawbacks of this method is that many of the terms used in the assessment are subjective, and therefore, this method may produce variable results. For example, the method asks the user to determine whether "favorable microsite condition is maintained by adjacent site characteristics," or "fluctuation of water is not excessive," but the document provides little guidance on how to interpret these terms. This method does not address biological requirements. In other words, a wetland can be determined to be in proper functioning condition, but may not support a species of interest.

Hydrogeomorphic (HGM) Approach for Oregon

The hydrogeomorphic approach (Adamus in progress) classifies wetlands based on three characteristics: geomorphic setting, water source and transport vector, and hydrodynamics. The method relies on using a set of reference wetlands in each wetland class to establish "attainable functions" for each region. The selected sample of wetlands in the watershed is then compared to the reference set. This method is currently under development for Oregon, and is not available for use or review; therefore, benefits and drawbacks are not addressed here. However, as it becomes available, it is expected to be an excellent tool to meet the needs of a watershed-scale functional assessment. Development of this tool was recommended in a document that provides strategies for wetland restoration in Oregon (Good and Sawyer 1997). That report also recommends the use of HGM by watershed councils.

Indicator Value Approach (IVA)

The IVA method (Hruby et al. 1995) assigns a numeric score to wetland function based on indicators of performance. The method is based on the assumption that wetlands having specific environmental indicators perform a wetland function better than those that do not have those indicators. The approach is to identify specific indicators of each function and assign additive, multiplicative, and fractional scores to each indicator. The benefits of IVA are that it provides a high degree of resolution between wetlands, can address unique watershed issues and concerns (because the set of questions are developed specifically for each watershed), and leads to numeric scores, which can be valuable if a goal is to prioritize wetlands for a specific purpose. The primary drawback to the method is that it requires specific development of the models for each function for each project, which increases the start-up time, and requires a time commitment of technical experts to assist in development of the model.

Wetland Evaluation Technique (WET)

WET (Adamus et al. 1991) is a method that evaluates 11 functions and assigns high, moderate, or low probabilities that a given function is performed. The benefits of this approach are that it is fairly rapid to use. The drawbacks are that it does not distinguish the level of performance of a function between wetlands which perform that particular function. It would probably not meet the needs of a watershed council if the goal is to prioritize wetlands for protection or restoration.

Conclusion

Selection of a method for a wetland functional assessment will be key in determining whether the data gathered is useful to address data gaps or meet other goals of a watershed council. Be sure that you understand the implications and limitations of the method that is selected for functional assessment. Also be sure that the experts assisting the watershed council with this step understand your goals for using the data. This will ensure that a technically sound and useful product is generated.

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GLOSSARY

channel confinement: Ratio of bankfull channel width to width of modern floodplain. Modern floodplain is the flood-prone area and may correspond to the 100-year floodplain. Typically, channel confinement is a description of how much a channel can move within its valley before it is stopped by a hill slope or terrace.

Channel Habitat Types (CHT): Groups of stream channels with similar gradient, **channel pattern**, and **confinement**. Channels within a particular group are expected to respond similarly to changes in environmental factors that influence channel conditions. In this process, CHTs are used to organize information at a scale relevant to aquatic resources, and lead to identification of restoration opportunities.

channel pattern: Description of how a stream channel looks as it flows down its valley (for example, braided channel or meandering channel).

conifer: Cone-bearing tree, generally evergreen (although certain exceptions occur; for example larch is a deciduous conifer), having needle-like leaves. Examples include pines, Douglas fir, cedar, and hemlock.

connectivity: The physical connection between tributaries and the river, between surface water and groundwater, and between wetlands and these water sources.

ecoregion: Land areas with fairly similar geology, flora and fauna, and landscape characteristics that reflect a certain ecosystem type.

Geographic Information System (GIS): A computer system designed for storage, manipulation, and presentation of geographical information such as topography, elevation, geology etc.

hydric soil: A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part.

hydrology: The science of the behavior of water from the atmosphere into the soil.

large woody debris (LWD): Generally defined as pieces of wood (either tree trunks, stumps, or large branches) greater than 6 feet long and greater than 4 inches in diameter. LWD is important in the formation of channel shape, and consequently, in creating and enhancing fish habitat. Sometimes referred to as coarse woody debris.

lentic riparian/wetland area: Lentic riparian areas have standing water, such as lakes, ponds, seeps, bogs, and meadows.

perennial surface water: Surface water that persists all year.

recruitment: In the context of riparian function, recruitment refers to adding new LWD pieces to a stream channel. It is the physical movement of LWD into the stream channel.

riparian area: The area adjacent to the stream channel that interacts and is dependent on the stream for biologic integrity.

Riparian Condition Unit (RCU): A portion of the riparian area for which riparian vegetation type, size, and density remain approximately the same.

Riparian Recruitment Situation: Groups of RCUs that have similar characteristics and that may be treated similarly for the purposes of restoration and/or enhancement.

seasonal surface water: Surface water that is normally only present during a portion of the year.

stereo aerial photo: Pairs of photos taken from the air that can be viewed through a stereoscope to reveal three-dimensional features of the landscape.

stereoscope: An instrument used to observe stereo aerial photographs in three dimensions.

wetland vegetation: Plants that are adapted to living in saturated or inundated conditions for at least part of the growing season.

Appendix V-A
Blank Forms

Form R-1: Riparian Condition Units

Name of Watershed:___________________________________Name of Analyst:_______________Date:________Page______ of ______

RCU #	Bank	Length (ft)	Stream/ Lake	Sub-water-shed	Eco-region	CHT	Stream Size	RA1 Width (ft)	RA1 Code	RA2 Code	Perm discon due to:	Shade (%)	Riparian recruitment situation	Notes

TERMS

RA1 Riparian Area 1

RA2 Riparian Area 2

Form R-2: Riparian Recruitment Situation Description

Analyst:___________________________________ Date:____________ Page _____of _____

Watershed:____

Riparian Recruitment Situation Name:____

Description:

Form R-3: Riparian Conditions Confidence Evaluation

Watershed:____

Analyst's Name:____________________________ **Date**________ **Page** _____ **of** ___

Resources used:

- ☐ ODF base maps
- ☐ Topographic maps
- ☐ CHT maps
- ☐ Land use maps
- ☐ Ecoregion map
- ☐ Ecoregion descriptions
- ☐ Aerial photographs
  - ☐ Black & white
  - ☐ Color
  - ☐ Color infrared

  Scale: 1:__________
  Source:______________________________
- ☐ Description of riparian vegetation and/or shade from stream surveys
  Source:______________________________
  RCU #s:____
- ☐ Field verification of riparian vegetation
  RCU #s:____
- ☐ Field verification of stream shading
  RCU #s:____

Confidence in riparian condition assessment:

☐ **Low:** Unskilled/unsure of procedure, didn't consult expert, no field-verification, no survey information used, potential for conditions to have changed since aerial photos taken

☐ **Moderate:** Some confidence in assessment procedure and personal skills, access to expert for help and/or review, some areas field-verified and/or covered by existing surveys, low potential for conditions to have changed since aerial photos taken

☐ **High:** Confident in using assessment procedure and/or personal skills, access to expert for help and/or review, extensive field-verification

Recommendation for additional field assessment; unanswered questions (if any) and why (complete on back of form):

Form W-1: Table of Wetland Attributes

Name of Analyst:____ Watershed:____

Date:____Page ______ of_____

Wetland ID	Sub-basin	Size (ac.)	Connected	Cowardin Code	Cowardin Code	Cowardin Code	Buffer	Watershed Position	Restoration Potential	Field?	Source	Comments

Form W-2: Wetland Confidence Evaluation

Watershed:____

Analyst's Name:______________________________ **Date**_________ **Page** ______ **of** ____

Analyst's wetland experience:

☐ **Low:** No prior experience

☐ **Moderate:** Some experience

☐ **High:** Extensive experience.

Analyst's overall familiarity with watershed during different seasons:

☐ **Low:** Unfamiliar

☐ **Moderate:** Somewhat familiar

☐ **High:** Very familiar (live and/or work in the watershed)

Origin of wetland base map:

☐ **Low:** NWI map based on photos 1980 or earlier

☐ **Moderate:** NWI map based on photos 1981 or later

☐ **High:** Other recent wetland inventory information available

Aerial photo interpretation:

☐ **Low:** No aerial photos used

☐ **Moderate:** Photos greater than 5 years old were used

☐ **High:** Recent (within 5 years) photos were used.

Seasonality of photos:

☐ **Low:** Photos taken during July, August, or September

☐ **Moderate:** Photos taken October through February

☐ **High:** Photos taken March through June

Level of field verification:

☐ **Low:** None

☐ **Moderate:** Some field verification (50% or fewer of wetlands visited)

☐ **High:** Extensive (Greater than 50% of wetlands verified)

Conditions in watershed:

☐ **Low:** Greater than 50% of watershed forested

☐ **High:** Less than 50% of watershed forested

Recommendations for additional field assessment; unanswered questions (if any) and why (complete on back of form):

Appendix V-B
Field Measurement of Stream Shading

FIELD MEASUREMENT OF STREAM SHADING

(Note: The following description is modified from Schuett-Hames et al. 1994).

Shade measurements should be taken approximately every 50 to 100 feet along the channel. Shade should be measured at a minimum of 5 points for each RCU. The measurement at each point is an average of four systematic canopy closure readings taken in the middle of the channel.

Use a spherical densiometer to estimate shade to the stream channel at each point. To take a densiometer reading, hold the densiometer 12 to 18 inches in front of you at elbow height. Use the circular bubble-level to ensure that it is level. Look down on the surface of the densiometer, which has 24 squares etched into its reflective face. The reflection of the top of your head should just touch the outside of the grid (see figure below). Imagine that each square is subdivided into four additional squares, so that there are 96 smaller quarter-squares. Envision a dot in the center of each quarter-square. Count the total number of quarter-square dots covered by the reflection of vegetation (see figure below).

Four readings are made at each point. Begin with a reading facing directly upstream (Up); then turn clockwise 90 degrees and take a reading facing the left bank (LB); then turn another 90 degrees clockwise and take a reading facing downstream (Dn); and finally turn clockwise another 90 degrees and take a reading facing the right bank (RB). To determine shade, sum the number of quarter-square dots obscured with vegetation for all four readings, multiply the result by 1.04 (correction factor), and divide this result by 4. The result is the average percent shade at that point. Average the percent shade at all points to get the average percent shade for the RCU. View into a convex spherical densiometer showing placement of head reflection and bubble-level. Visualize four spaced dots in each square and count the number covered by vegetation.